Climate-change simulations with the Phase 5.3.0 model of the Chesapeake Bay Watershed

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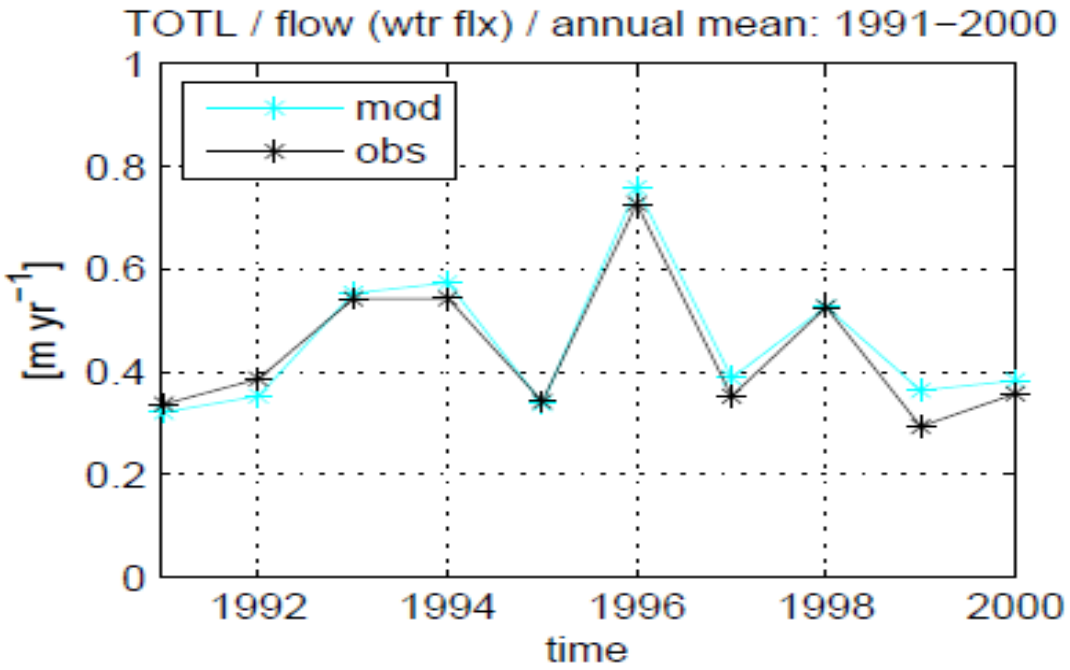
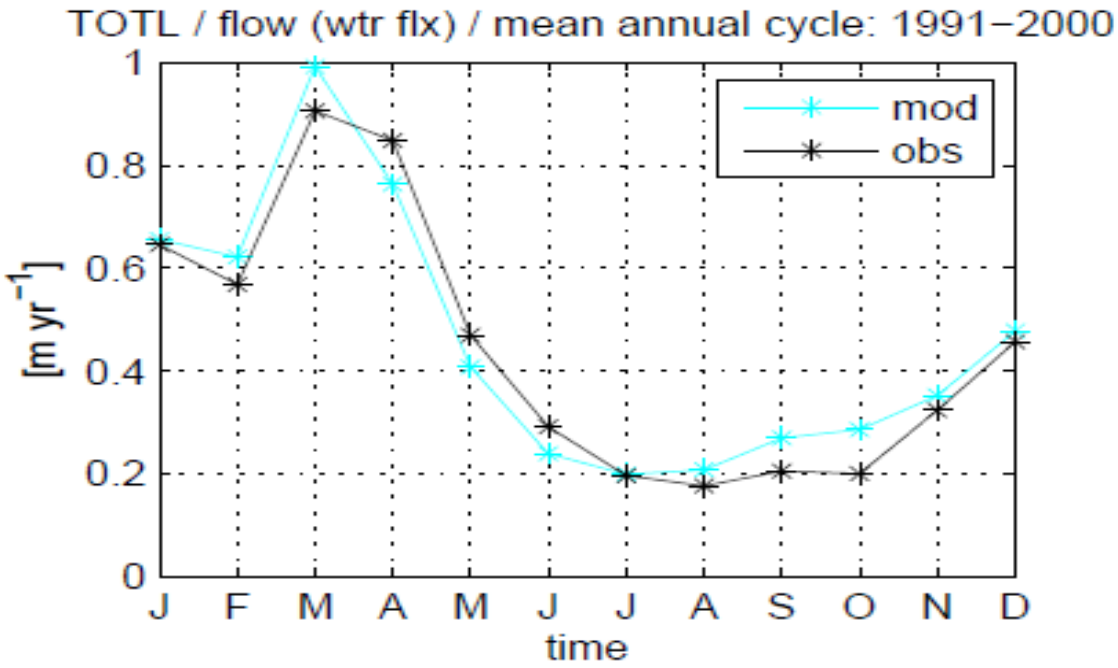
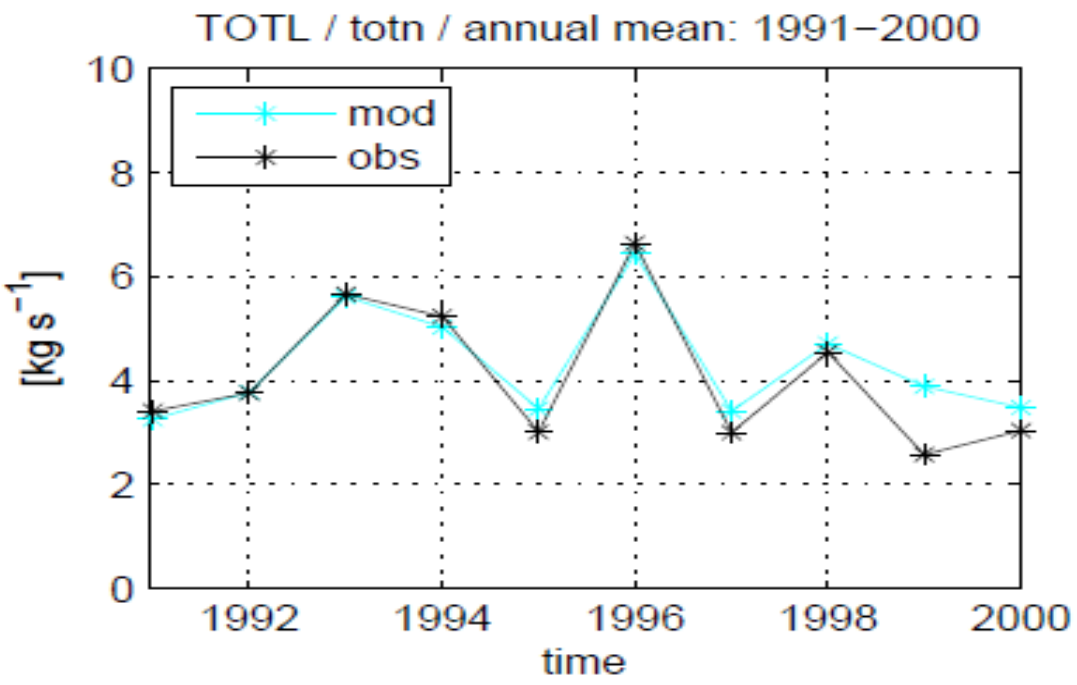
- Six global climate models
- 10-year simulations
- Mean annual cycle in T and P altered
- A2 emissions
- Last decade of 21st century
- Focus: watershed-wide results

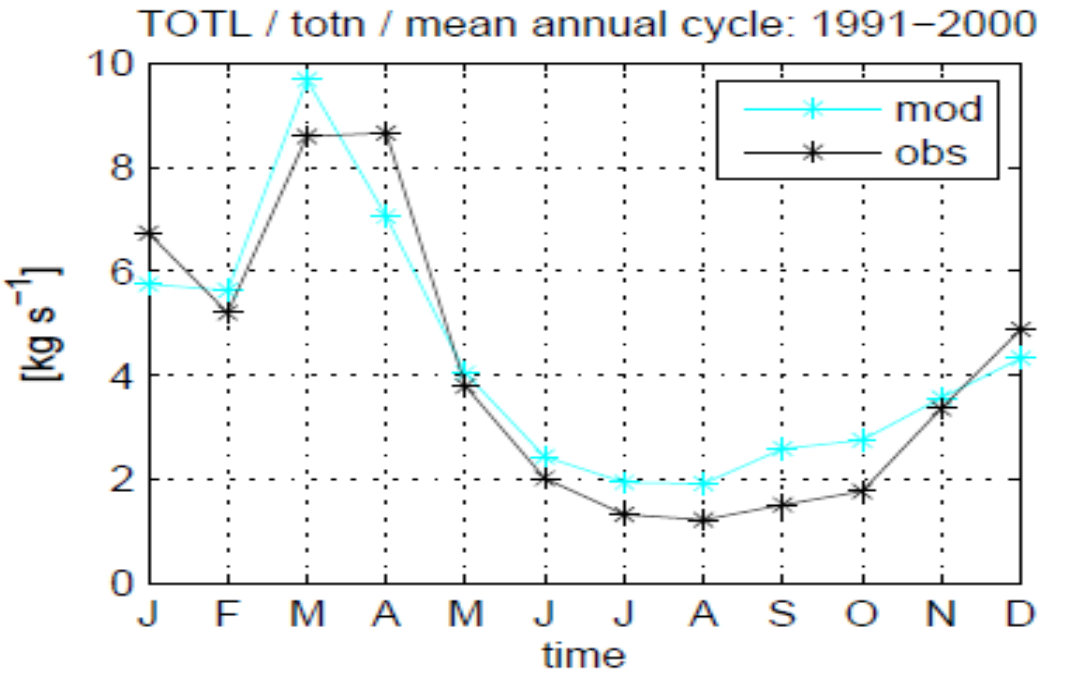
Model evaluation: streamflow



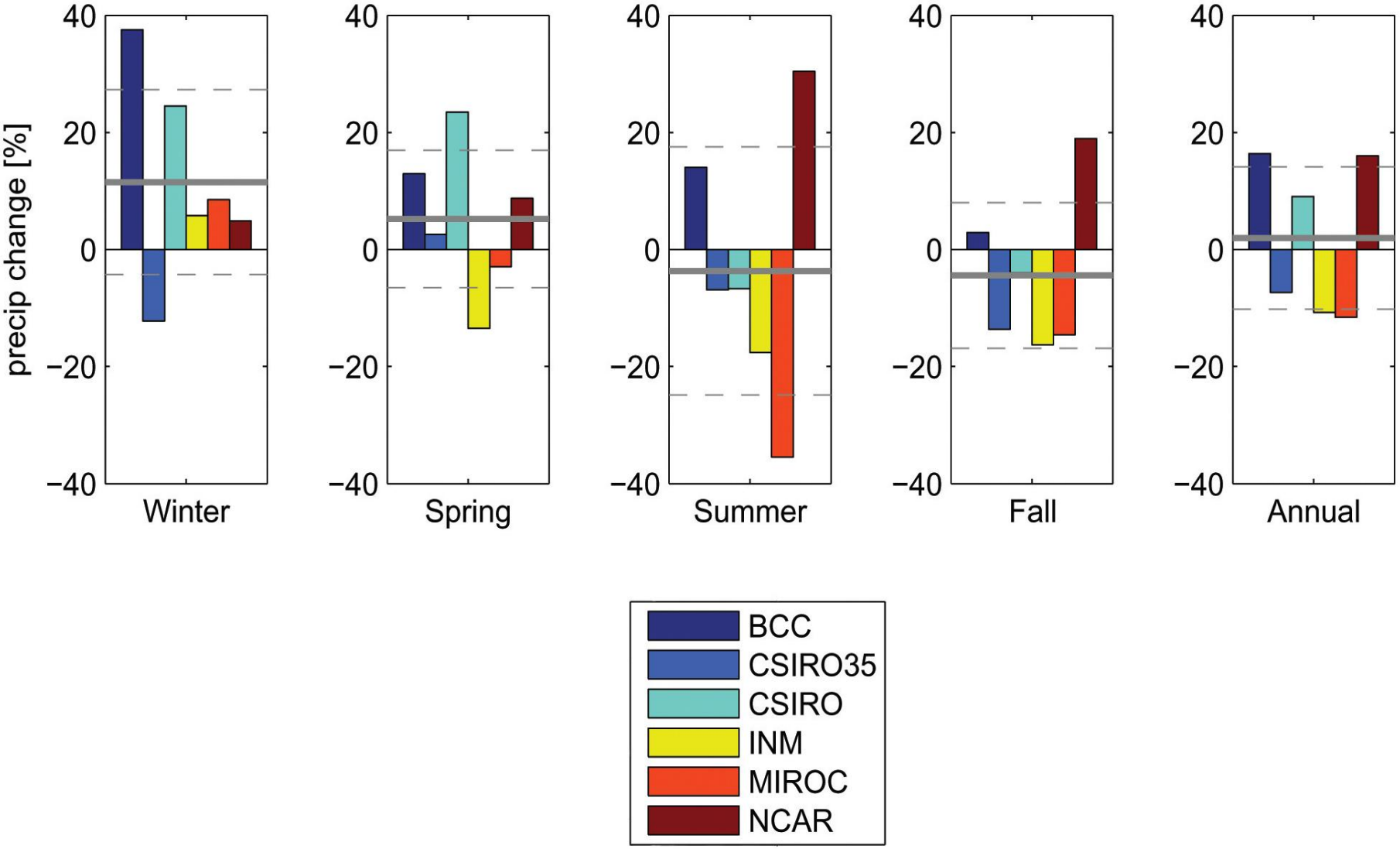


Model evaluation: N loading

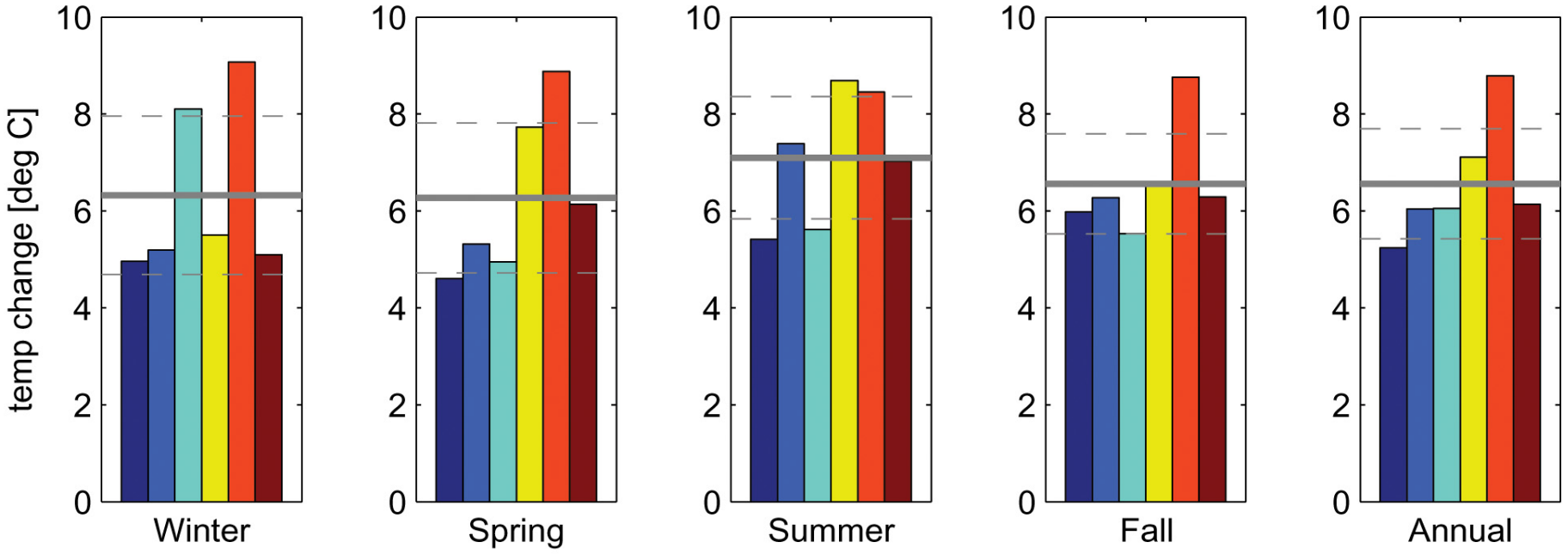




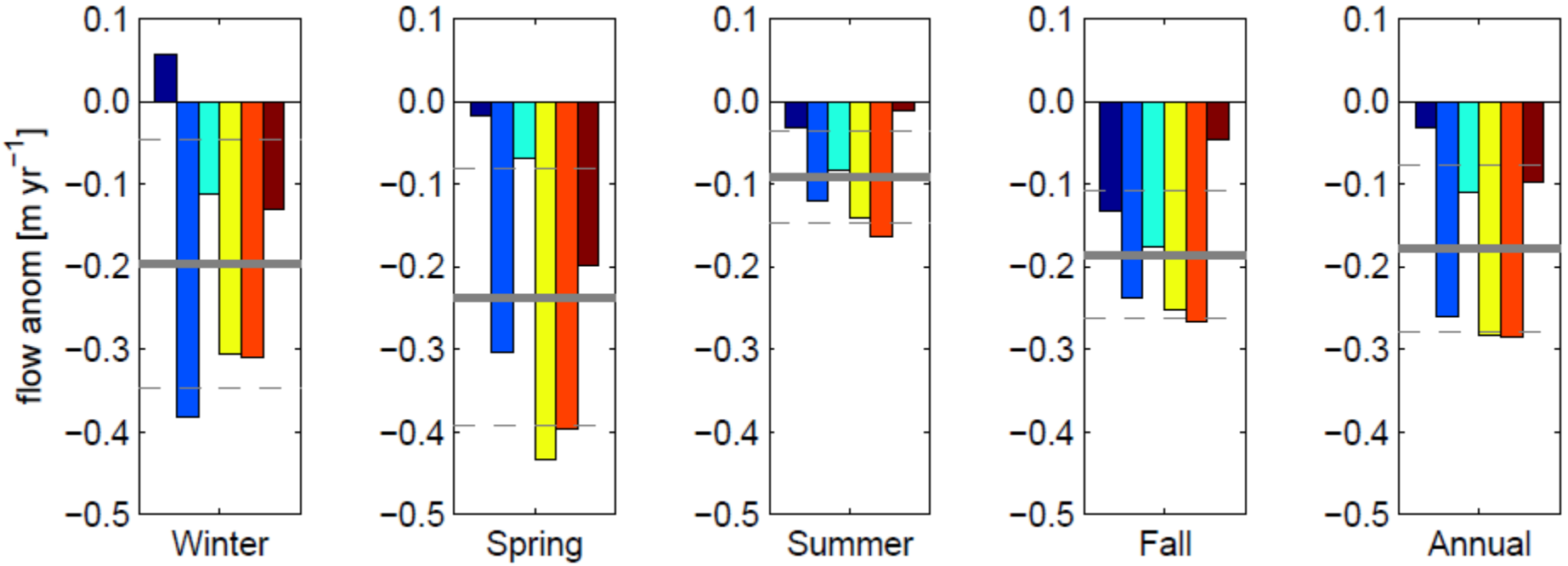
Projected precipitation change



Projected temperature change

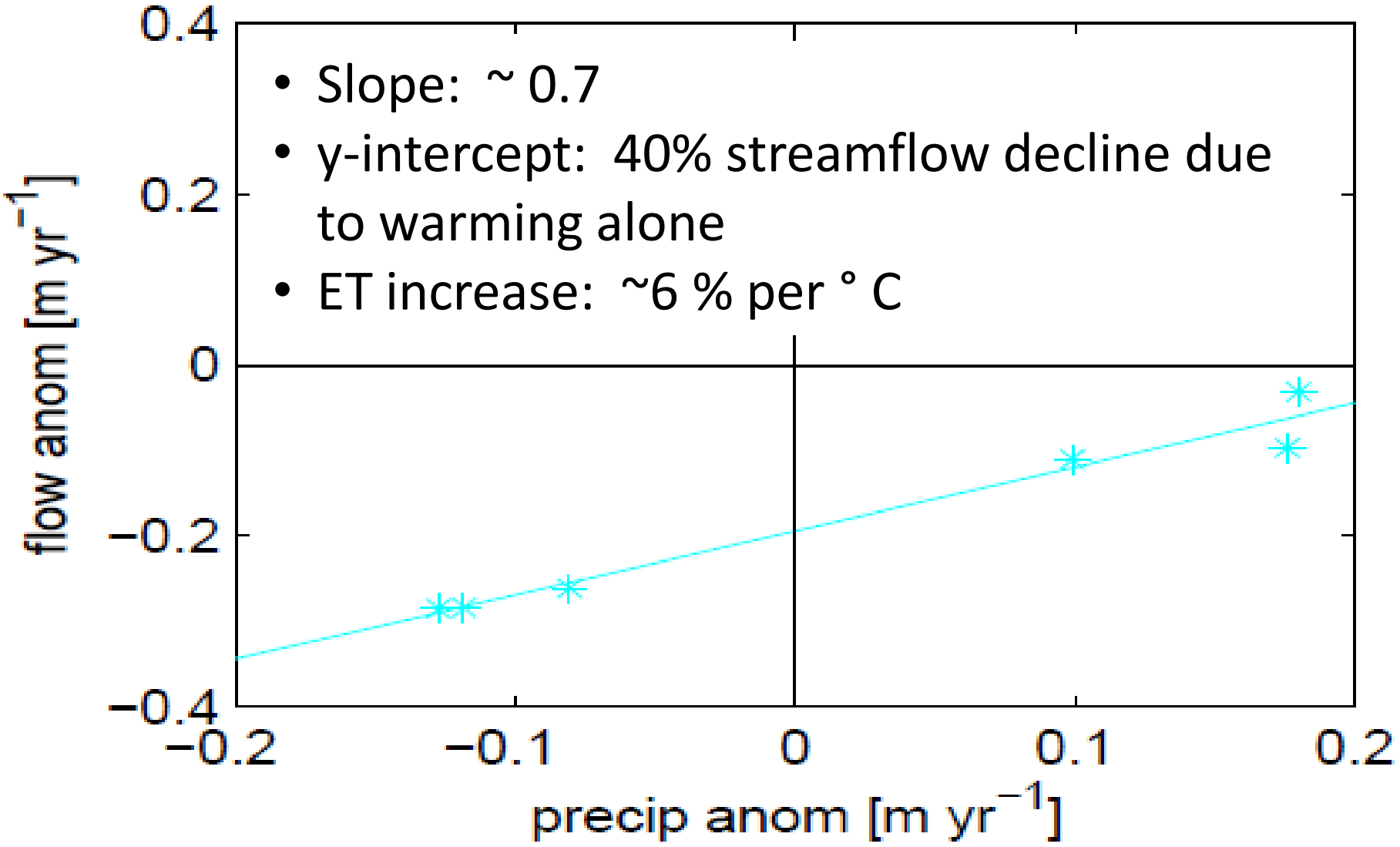


Projected changes in streamflow

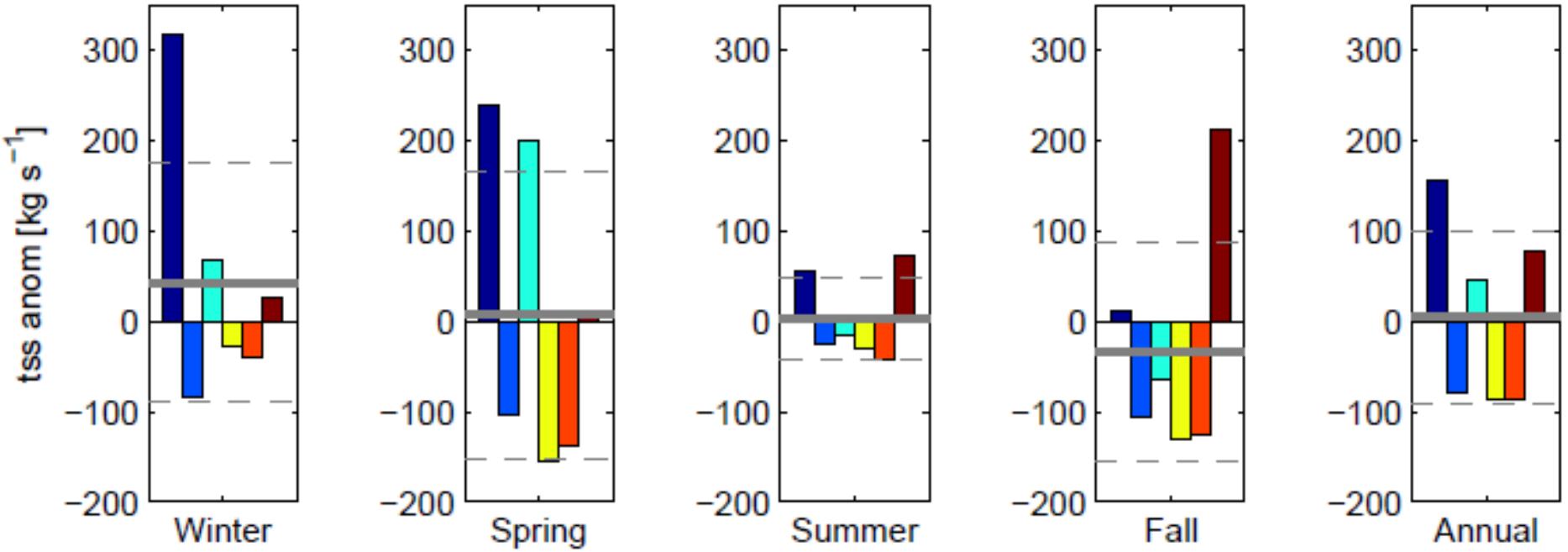


Annual baseline ~ 0.5 m yr^{-1}

Relationship between changes in annual precipitation and streamflow

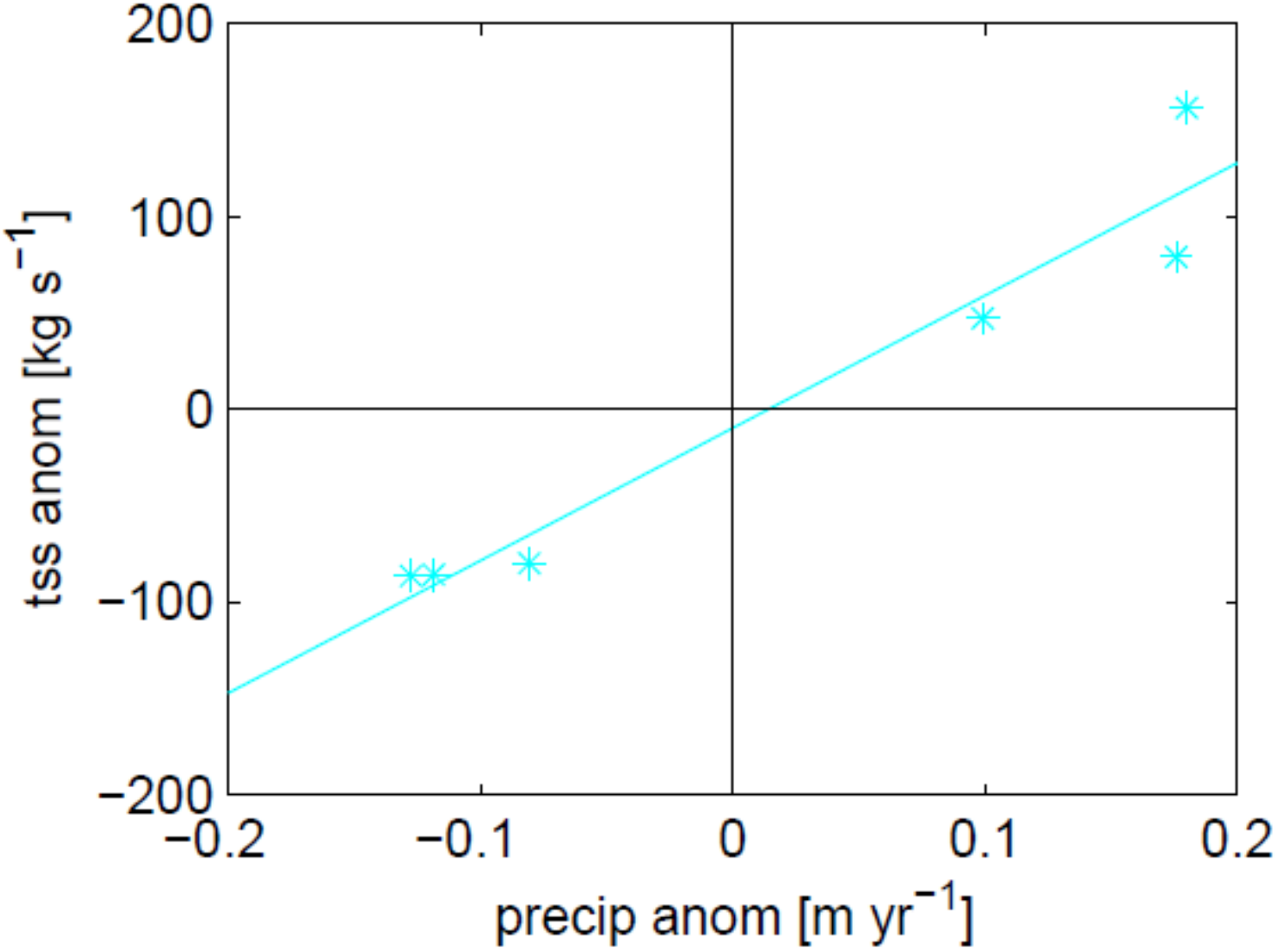


Projected changes in sediment loading to Bay

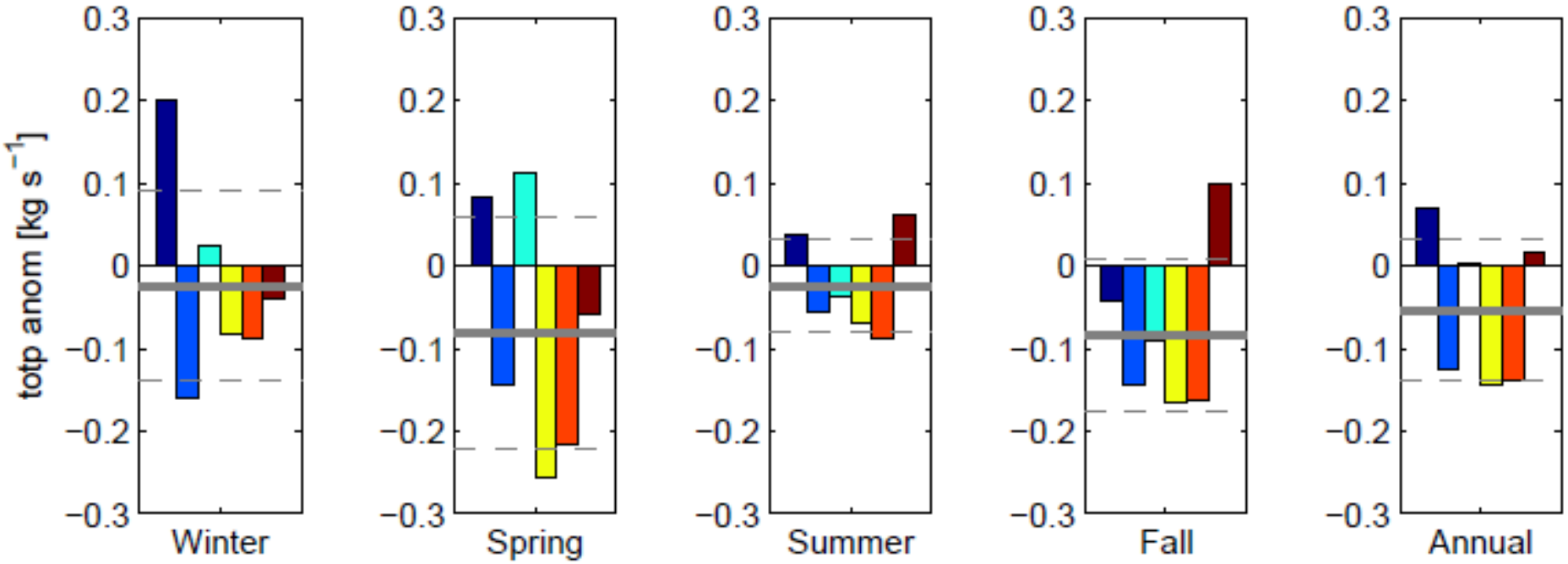


Annual baseline ~ 100 kg s^{-1}

Relationship between changes in annual sediment load and precipitation

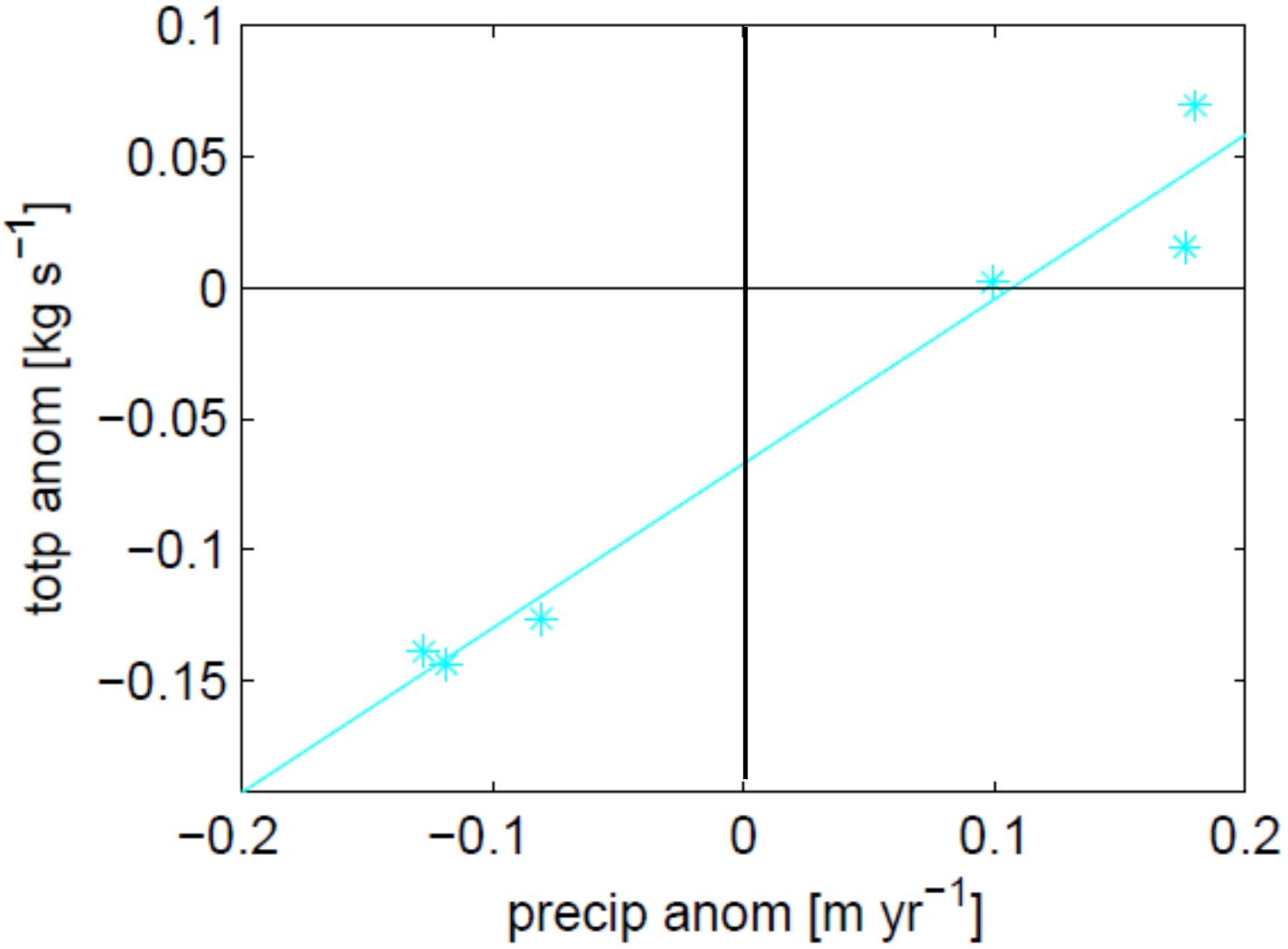


Projected changes in P loading to Bay

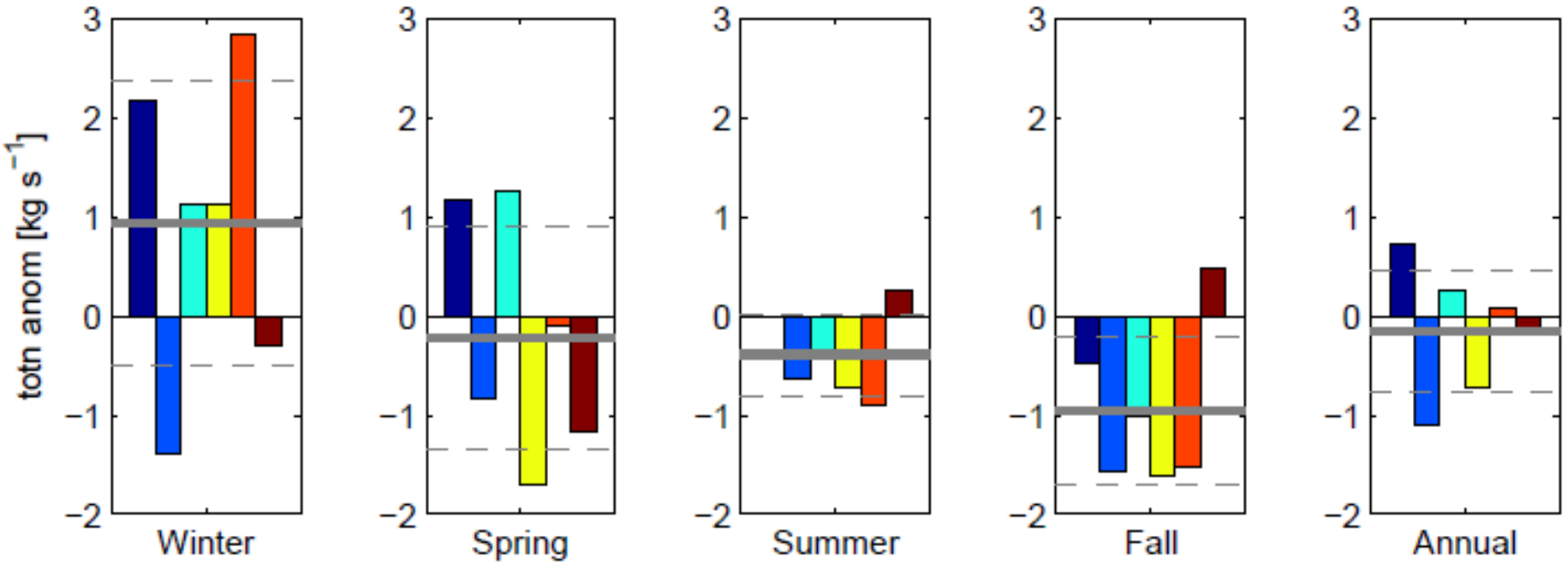


Annual baseline ~ 0.2 kg s^{-1}

Relationship between changes in annual P load and precipitation

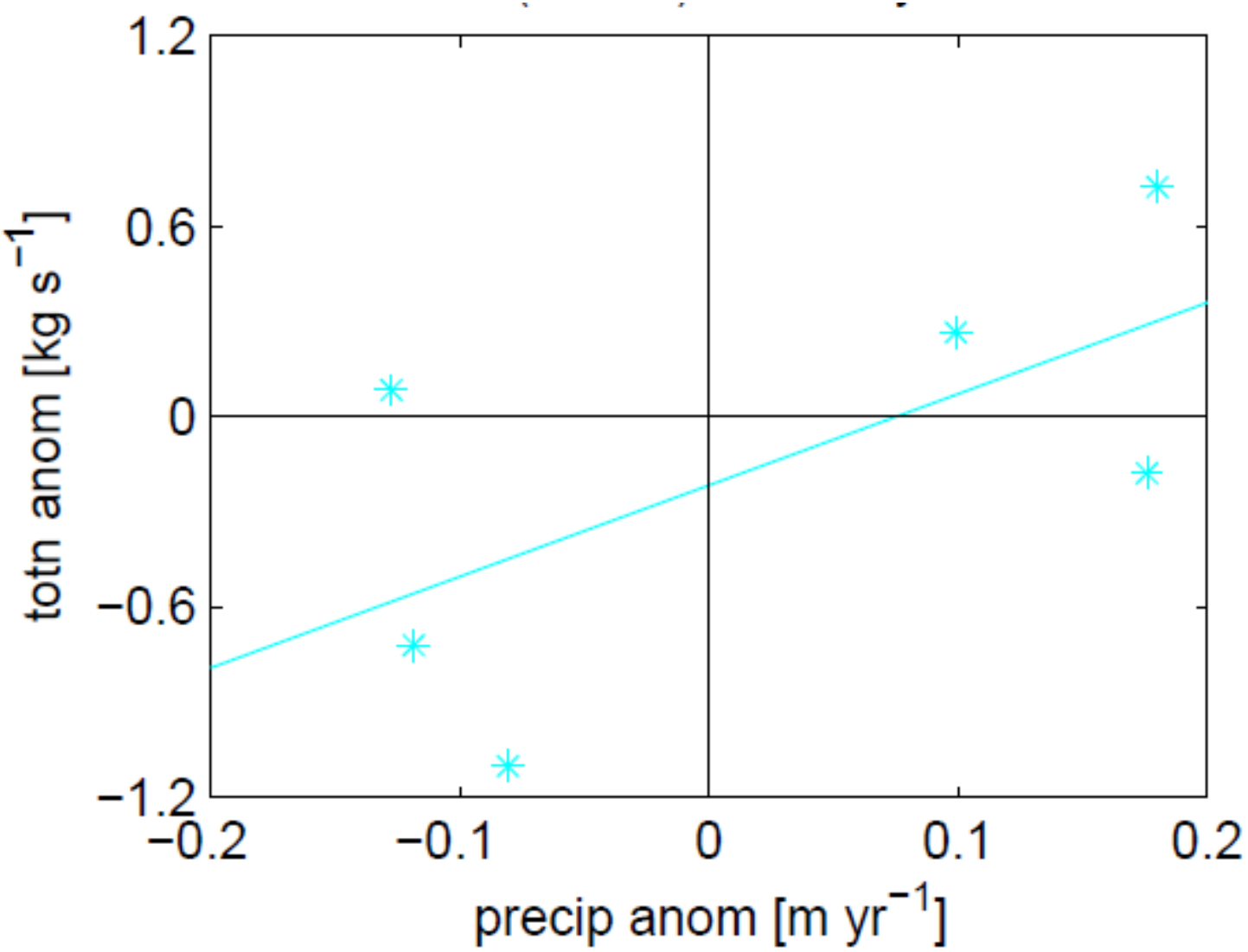


Projected changes in N loading to Bay



Annual baseline ~ 4 kg s^{-1}

Relationship between changes in annual N load and precipitation



Projected changes are significant

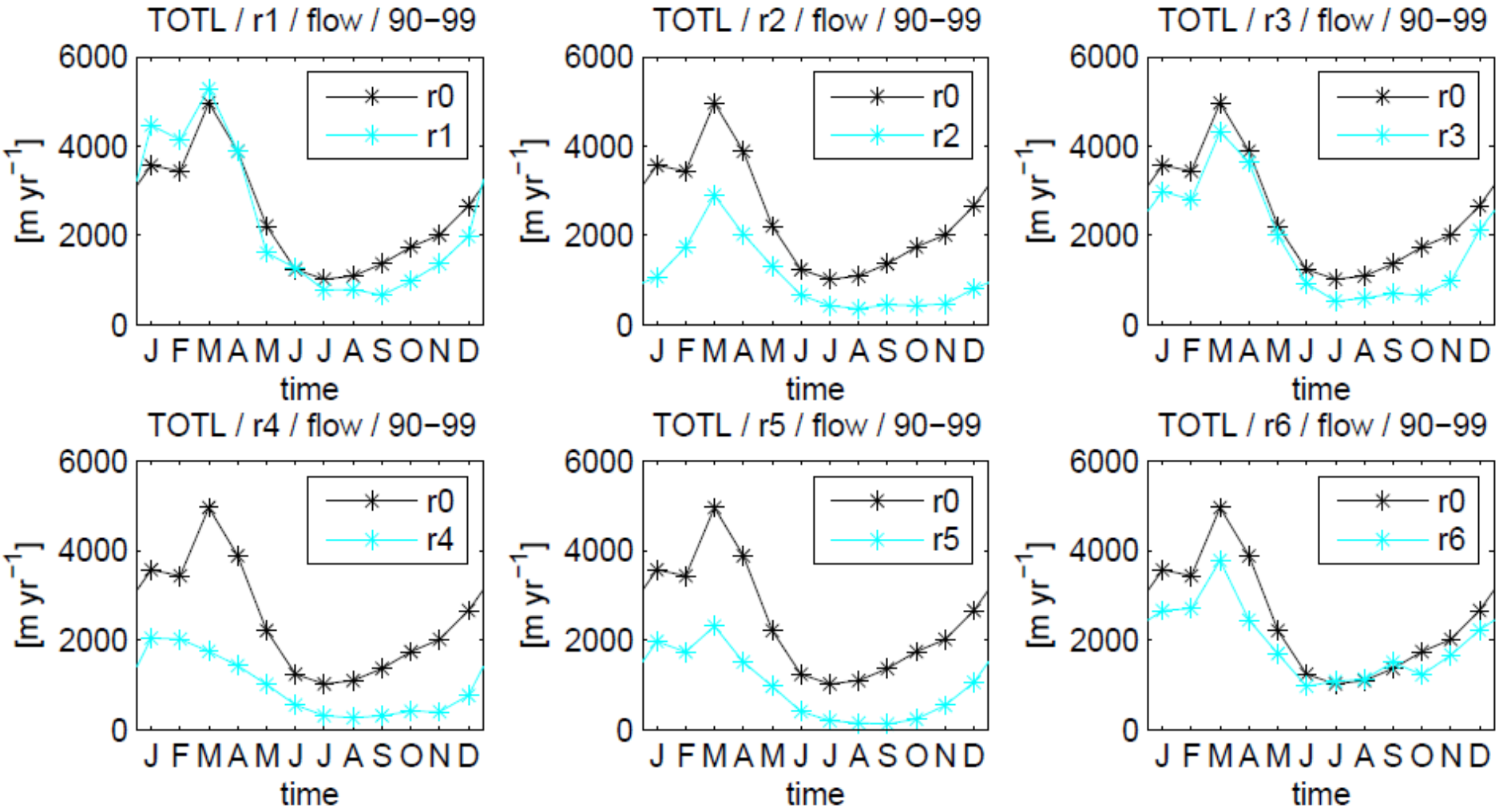
	Projected changes (%)
Streamflow	-5 to -60
N Flux	-25 to +20
P Flux	-60 to +30
Sediment Flux	-90 to +150

Thoughts?

Climate forcing

- All models warm in every season
- Slightly more warming in summer, on average
- Precipitation projections vary considerably among models
- Tendency to be wetter in winter and spring, drier in summer and fall
- Models that get wetter tend to warm less than models that get drier

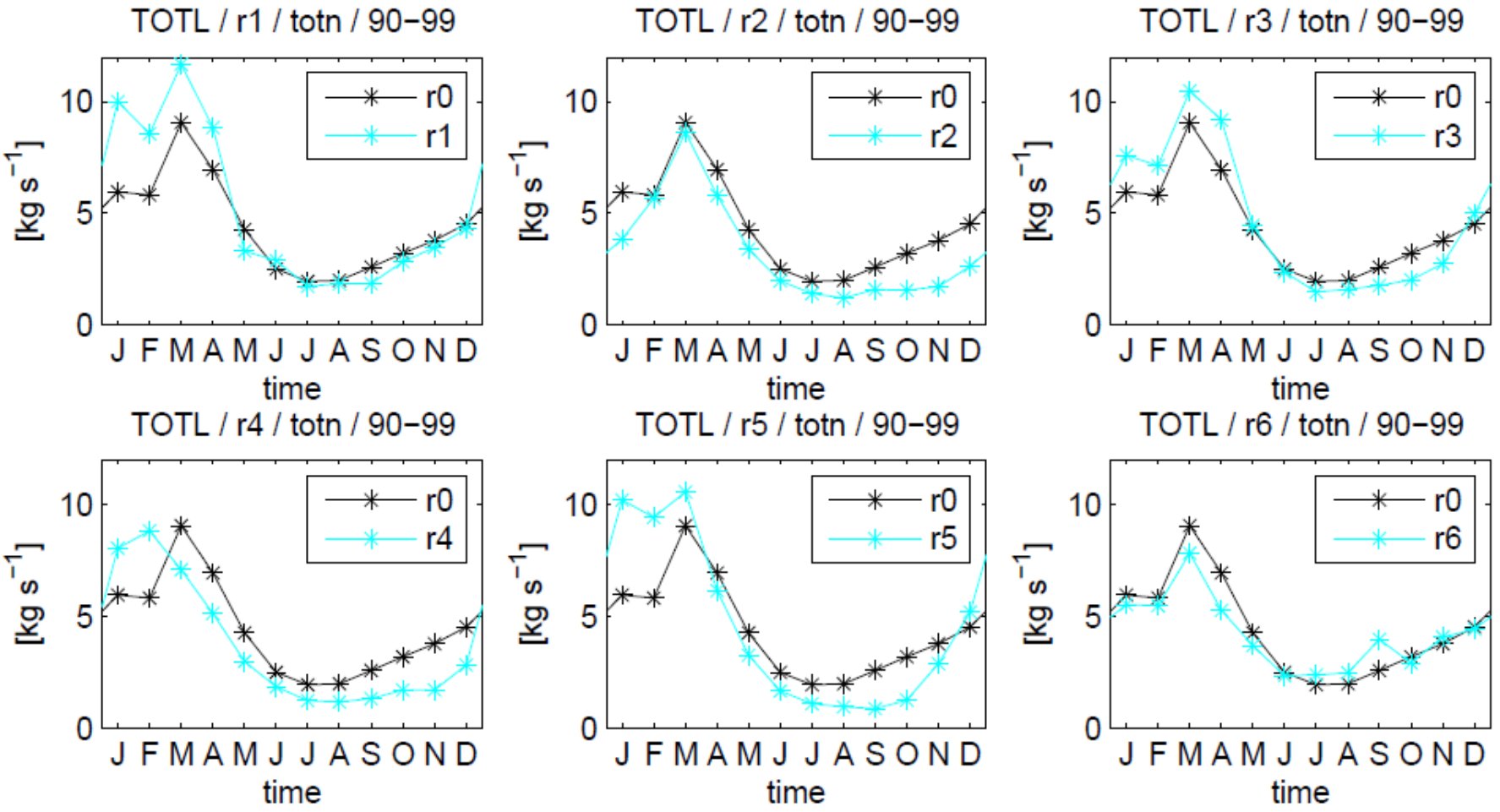
Projected changes in streamflow



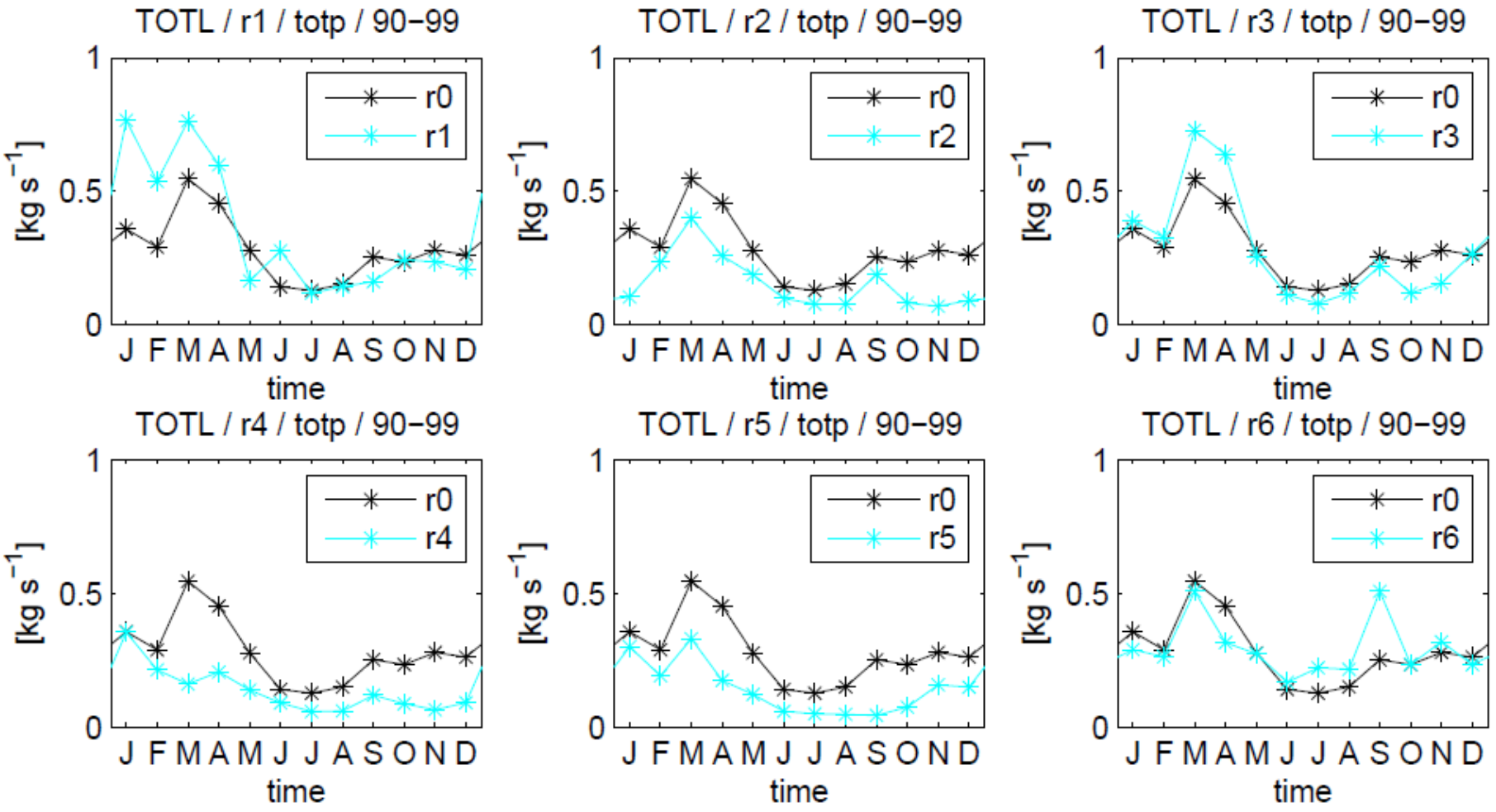
Streamflow summary

- All models shown decreases in every season with one exception (out of 24!)
- Some flow declines are very dramatic
- Temperature and precipitation effects need to be separated, but it appears that temperature plays a dominant role
- Note: historically, temperature has played a weak role in the interannual variability of streamflow but a strong role in the seasonality of streamflow

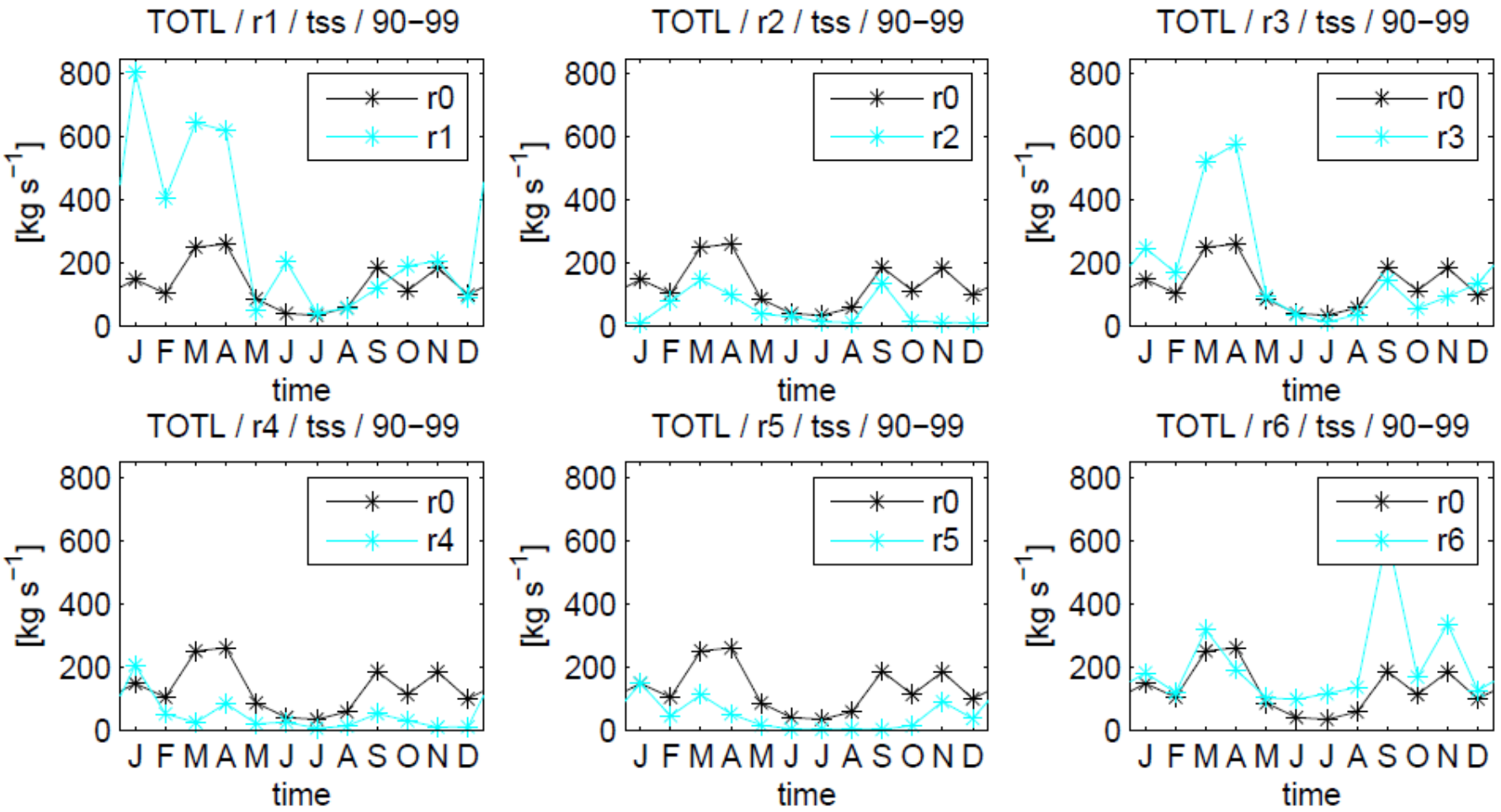
Projected changes in N flux to the Bay



Projected changes in P flux to the Bay



Projected changes in sediment flux to the Bay



N, P and sediment summary

- Changes in these fluxes do not exactly mimic streamflow changes
- For some models, the streamflow decreases and the N, P, and sediment fluxes increase
- Warming appears to increase the N, P, and sediment concentrations in rivers
- The changes in N, P, and sediment fluxes are generally correlated, but there are cases when they differ in the direction of change